PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1957-58

TANGANYIKA TERRITORY
EASTERN PROVINCE

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E.C.G.C. STAFF LIST.

ILONGA.

Plant Breeding	... ...	R. SMITH, B.Sc.
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TANGANYIKA TERRITORY
EASTERN PROVINCE
PROGRESS REPORT FOR THE SEASON 1958

BY

R. SMITH and E. W. VALENTINE.

Cotton Season.

Planting: February to April.

Picking: July to December.

Legal uprooting dates by districts:

Kilosa, Kisarawe and Ulanga	31st October.
Morogoro (excluding Duthumi)	15th November.
Bagamoyo and Duthumi	30th November.
Rufiji	15th January.

Rainfall (Ilonga): December to June. 32·97 inches.

Introduction.

BY

R. SMITH.

Ilonga Station.

Meteorology.—The rains were late and the total for the cotton season was slightly lower than usual, 32·97 inches, compared with a 10-year average of 36·69 inches at Ilonga. The distribution was poor, rain falling in three one-week periods in mid February, late March, and the end of April. The maximum average temperatures remained at 90° F. until early May and minimum temperatures averaged 70° F. until mid May.

Staff, visitors and visits.—Both members of the E.C.G.C. staff were present during the whole of the year. During the growing season Mr. Smith was assisted by Mr. C. Y. Mpupua, who gave considerable help in the field, in training instructors, and in showing many parties of cultivators round the cotton plots.

Visitors to the station included Mr. A. P. S. Forbes, Director of Agriculture; Mr. D. F. Ruston, Secretary, E.C.G.C.; and Mr. M. H. Arnold, E.C.G.C., Ukiriguru.

The annual research conference for the Central Region was held at Ilonga under the Chairmanship of Dr. A. C. Evans, Chief Research Officer. Ilonga is the agricultural research centre for the Central Region of Tanganyika.

The Plant Breeder toured all the district plots in the Eastern, Tanga and Northern Provinces and the Lumemo and Mbarali trial irrigation farms. The Entomologist visited the irrigation sites. He also attended the Specialist Committee of Entomology at Kawanda, visiting Ukiriguru on the way.

Cotton Growing—Eastern Province.

The cotton production in the Eastern Province this season is about 15,000 bales, a post-war record. This increase is due to earlier plantings and larger acreages under cotton. It reflects the increased interest of the growers, the hard work done by the Department of Agriculture extension officers, and the interest shown by the Administration. More interest is being evoked in Tanga and Northern Provinces, and while the price of cotton remains relatively high the outlook is fairly optimistic. Use of insecticide is progressing amongst individual growers; to date, over 300 people in Kilosa district and 60 in Bagamoyo district have expressed a willingness to buy dust, and several pilot spraying projects are planned, at the request of growers, for next year.

In order that I158, the replacement for 47/10, can be multiplied quickly, 1,000 acres are to be planted in Morogoro and Ulanga districts with this new seed. The Morogoro planting will be sprayed. These multiplication areas should provide a focus of interest and a demonstration to many growers throughout the Province. Visits to Ilonga have been most useful in the past in this respect.

The initial multiplication of I158 this year at Chabe was not as successful as was originally hoped. Nevertheless over 40 tons of seed are available for next season from the 3,000 lb. planted and a number of lessons have been learnt. The major difficulty was the easily satisfied wants of the growers, who failed to pick all the crop.

Doubts were also expressed about the advantages of I158 over 47/10, but comparable results from replicated trials over the Province showed that I158 gave an average increase of 12% in yield and 0·4% increase in ginning outturn in this, an unorthodox year—thus allaying these doubts. All the cotton in the Chabe multiplication area (330 acres) was dusted with insecticide and the majority of growers were well satisfied with the results. The dust was provided by the Department. Of the 220 independent growers in Kilosa district using insecticide most were pleased with the yields obtained—over 2,000 lb./acre seed cotton in several cases.

At Ilonga the average yield was 2,000 lb./acre seed cotton. All trials and bulks were sprayed this year making applications a pleasanter job and resulting in improved yields.

Agronomy.

by

R. Smith.

District Plots.

The main emphasis was laid on collecting data to show the best methods to grow cotton in the Province generally. From previous Ilonga experience the various methods of cotton cultivation were compared. Trials were conducted at 7 district plots in Eastern Province, one in Tanga Province and two in Northern Province. The distance of these plots from Ilonga ranged from 100 to 400 miles. All plots were staffed with African recorders from Ilonga.

It is difficult to generalise from the information obtained, as environments varied from the well watered flat, alluvial areas of Kissaki, to the drier undulating hills of Bagamoyo, with intermediate conditions between these extremes in other areas.

The Northern Province trials were both irrigated and are reported later.

The results obtained at the Tanga and Eastern Province plots are shown in Table 1. Only the mean values for the main effects over all sites are shown, for simplicity of presentation.

Table 1.

Agronomy trial, 1958.

District plots.

Twelve treatments planted at each of 7 sites: Kiberege, Mikese, Kissaki (2), Miono (2), Handeni. Analysed as a split plot design. Insecticide application. Routine recommendation of 1 lb. DDT/acre/week for 8 weeks with 0·1 lb. BHC added.

Mean yield in lb./acre seed cotton.

Planting dates		*Spacing*		*Insecticide application*	
Plot size 1/25 acre.		1/50 acre		1/150 acre	
February	820	3′×1′, 1 plant/hole	816	Spray	1033
March	680	3′×3′, 2 plant/hole	685	Dust	736
				Control	489
S.E.	±56		±28		±91
L.S.D. (P=0·05)	N.S.		86		262

Period of maximum insect attack (February planting).

	Handeni.	*Miono.*	*Kissaki.*	*Mikese.*	*Kiberege.*
	27/4-22/6	11/5-13/7	20/4-20/7	30/3-8/6	4/4-16/6
Percentage damaged bolls attributed to:—					
Bollworm:	74	60	58	61	69
Stainer:	26	40	42	39	31

Treating each site as one replication, the results were analysed as a randomised block experiment with split plots; the analyses showed the following.

1. February planted cotton yielded better than March planted cotton.
2. The closer spacing yielded significantly better than the wide spacing.
3. Insecticide use gave significantly better yields and a good profit over the cost of the insecticide.
4. Spraying was better than dusting.

The table shows the intensity of insect attack, as reflected by the yield in the no insecticide plots, and the degree of control achieved by the spraying and dusting. The cost of insecticide was 80/- for dust and 140/- for spray.

Ilonga.

At Ilonga, eight 1/10 acre demonstration plots were planted for the benefit of visiting cultivators. Treatments ranged from the best methods of growing cotton, i.e. February planted, close spaced and clean weeded with insecticide applied, to cotton late planted, unweeded, unthinned, interplanted with maize and with no insecticide used. As planting rains were late these plots were dry planted 10 days before rain fell. Despite this, stands were good and germination excellent.

A spacing trial gave the results shown in Table 2.

TABLE 2.

SPACING TRIAL—ILONGA.

Randomised blocks, 3 treatments, 6 replications. Plot size harvested 1/81 acre. Planted 11/2/58. Routine spray insecticide.

	Yield in seed cotton lb./acre.
3′ × 1′, 1 plant per hole:	1166
3′ × 1′, 2 plants per hole:	1180
3′ × 3′, 2 plants per hole:	1053
S.E.	±95
	N.S.

On an African garden just beyond the station boundary, planted to cotton, sulphate of ammonia was applied. This garden has been cropped for the past 10 years, food crops being mainly grown. The results are shown in Table 3.

TABLE 3.

NITROGEN APPLICATION—ILONGA AREA.

Randomised blocks, 3 treatments, 3 replications. Plot size 1/9·68 acre. Planted 12/2/58. Routine dust insecticide. Sulphate of ammonia—half applied on 19/3/58 and half on 27/4/58.

	Yield in lb./acre seed cotton.
No sulphate of ammonia	1468
100 lb.	1565
200 lb.	1839
S.E.	±112
	N.S.

Plant Breeding.

BY

R. SMITH.

General.

The aims of the plant breeding programme are the same as reported last year, i.e. high yield, jassid resistance, early maturity, and improved ginning outturn.

That breeding varieties for the highest standard of cultivation is not entirely satisfactory has been shown by questions asked regarding the inherent qualities of I158 this season. Ideally the crop should be early planted and close spaced, and insecticide should be used. In practice many growers plant early, a few use insecticides, and some plant late.

Therefore, in assessing new varieties for use in this area, it is important to find out how they react to: —

(1) heavy insect attack;

(2) mild insect attack;

(3) protection from insects (this will vary from complete to poor protection depending on the type of attack and the efficiency of the application of insecticide);

(4) late planting;

(5) differing climatic conditions;

(6) varying localities.

Next year, all the district plot trials will be designed to provide answers to these questions. It is hoped that a reasonable degree of consistency will appear in the results and that a variety showing improved yield in one set of conditions will show some improvement in the other circumstances too.

Differences between the strains under trial this year have not been as great as in previous seasons. This could be due to lower rainfall, which may have prevented the better strains from displaying their inherent abilities, or to more effective insecticide applications in the form of sprays, which may have obscured increased yielding ability attributable to recovery from insect attack.

However, confirmation that the right approach has been used to date is shown by the yield trial results obtained this year, and the results from Ukiriguru (M. H. Arnold), shown in Table 4.

TABLE 4.

GRADING FOR RESISTANCE TO BACTERIAL BLIGHT BASED ON NEEDLE-PRICK INOCULATION OF STRAINS GROWN AT UKIRIGURU.

Strain	*Stem resistance Mean grade (scale 0-6)*	*Boll resistance Mean lesion diameter in mm.*
47/10	4·02	6·58
51/77	3·48	6·04
Uk51	2·13	4·91
S.E.	±0·16	±0·25
L.S.D. (P=0·05)	0·45	0·71

Up to the present, major crop loss has been attributed to insect damage, but from Table 4 it appears that strains with a degree of bacterial blight resistance are those producing higher yields, and either bacterial blight is more prevalent than has previously been supposed or the genetical balance of the more efficient plant types contains some degree of resistance. Observations at Ilonga this season showed that leaf infection occurred on most plants, stem lesions developed on 15% of the plants and boll lesions were present but negligible.

Differences in jassid damage between selections tend to be hidden by insecticide applications. In future, small plots of each strain will be grown without insecticide, to assess jassid resistance.

Under local conditions, ginning outturn tends to be low. This season the ginning percentage of 47/10 has varied from 27·7 to 30·6 at different ginneries in Eastern Province. Low lint indices are associated with the low G.O.T. Therefore, in an endeavour to increase the level of G.O.T. in the mass of selection material, all strains giving low ginning outturn have been discarded, irrespective of improvements in other characters within these strains. The whole problem of G.O.T. variation from place to place and season to season appears complex from the results obtained over the past two years and requires thorough investigation.

TABLE 5.

LINT QUALITY. SMALL SCALE SPINNING TEST RESULTS, 1958.
Tests performed by Shirley Institute.

Place grown	*Strain*	*Effective length 1/32″*	*Maturity ratio*	*Fibre weight mean*	*Fibre weight standard*	*Bundle strength (g/tex) at 1/8″*	*Corrected lea count × strength product*
Ilonga	I158	43	0·80	134	168	21·2	2205
	47/10	42	0·825	150	182	18·1	1901
Kissaki	I158	44	0·86	135	157	20·9	2188
	47/10	42	0·835	144	173	19·9	1836
Miono	I158	42	0·84	136	162	21·7	2192
	47/10	40	0·84	172	205	19·1	1842

The majority of selections show spinning qualities at least up to the standard of the present commercial variety. The point to be

watched in future is yarn appearance. To quote the results from the Shirley Institute (to whom thanks are due) when samples of I158 were compared with 47/10:—

"The fibre test results show that the superior yarn strength given by all the I158 samples, except that from Chabe, can be accounted for by the greater length, strength, and fineness of this strain. The increased tendency to neppiness of I158 is probably a result of its greater length and fineness".

This year is the first time that adverse reports on lint appearance have been made. Faults connected with a 12″ Macarthy gin used this season for the first time may be the cause of the trouble.

The mean dates of maturity were calculated for the strains in the variety trials planted at Ilonga. Table 6 shows the number of days from the first pick for Ilonga and imported varieties. It will be noticed that the crop matured earliest in the Ilonga strains, later in the varieties from Lake Victoria areas, and very late in the Sudan types.

TABLE 6.

MEAN DATES OF MATURITY—ILONGA.

Data from variety trials.

Origin	*Strain*	*Mean date of maturity in days from 1st pick (date of 1st pick = 0).*
Ilonga	I158	24·8
	47/10	27·7
Range of Ilonga selections		15 days to 33 days
Uganda	UPA8	30·0
Lake Province	6/552	30·8
Sudan	BLR 14/25	49·5

The mean date of maturity was obtained by calculating, for each picking, amount per picking multiplied by the days from the first pick, summing these, and dividing by the total yield.

Selection and Testing.

The plant breeding programme is developing along three main lines.

1. Testing of selections and reselections from local stock.
2. The use of progeny rows and the selection index technique.
3. Panmixis bulks for raingrown and irrigated types.

A further 1,400 single plant selections were made this season from selections and reselections made in 1954, 1955, and 1956. Of these, 330 will be planted next year. The remainder have been eliminated on G.O.T., lint length, and lint index measurements. Field characters will be studied next year and the remaining strains planted in yield trial the following season.

Three variety trials were conducted. The main variety trial of 16 strains, 4 × 4 balanced lattice, 5 replications, plot size 1/242 acre, was planted at Ilonga and all district plots. Amongst these strains, jassid

resistance showed improvement over the control but no strain was outstanding. The best yielding strains tended to have low ginning outturns.

TABLE 7.

ILONGA AND DISTRICT PLOTS.

Performance of best 3 strains and controls. Yields of lint expressed as percentages of lint yields of 47/10. Planting between 1st and 10th February.

Strain	*Ilonga*	*Kissaki* (1)	*Kissaki* (2)	*Mikese*	*Miono* (1)	*Miono* (2)	*Handeni*	*Uru Chini*
54/155	109	127	138	110	96	110	92	92
275	120	123	123	128	130	118	103	111
298	113	135	113	117	114	102	94	81
Il58	106	119	118	115	124	99	89	93
47/10	100	100	100	100	100	100	100	100
Uk51							79	—
BP52								97
S.E.	±4%	±4%	±8%	±3%	±5%	±9%	±3%	±8%
L.S.D. (P=0·05)	11%	11%	24%	10%	15%	26%	8%	22%
Mean lint yield per trial in lb./acre	693	451	417	557	275	328	636	870

Locality means of the five strains below.

Ginning outturn	31·7	29·7	31·9	30·5	33·2	31·7
Lint index	4·1	3·7	4·0	3·7	4·2	4·7

Strain means over the six localities.

	54/155	54/275	54/298	Il58	47/10
Ginning outturn	32·1	31·1	31·7	31·0	31·2
Lint index	4·4	4·1	3·9	3·9	4·0

Uk51 (Handeni only), ginning outturn 31·7, lint index 4·4.
BP52 (Uru Chini only), ginning outturn 30·3, lint index 4·4.

Table 7 shows the results for the best 3 strains. 5 strains have been kept for further testing.

In the 54/55/R types trial, 7 × 7 balanced lattice square, 4 replications, plot size 1/484 acre, improved jassid resistance was noted. Yield increases were small in the main. 54/379 was the best strain, but a UPA selection from Namulonge did well, having a high yield, fairly good jassid resistance, low bacterial blight infection and a high lint index, but a later date of maturity.

Nine strains have been kept of the 47 planted.

In their first year of trial the seventy-seven 1956 selections showed advances up to 29% in yield; G.O.T. was generally high, and 5 strains were scored very good for jassid resistance. In this trial, 9 × 9 balanced lattice square, 5 replications, plot size 1/484 acre, 14 strains were selections from 51/77. These gave low ginning percentages and only 4 have been kept. 37 strains were direct selections from 51/111; these were better than the 51/77 selections in both G.O.T. and yield,

and 19 were kept. The remaining 26 strains, selected from Eastern Province Local or reselections from the 1953 selections, gave wide variations for G.O.T., yield, lint index, and jassid resistance. 11 of these have been kept. One strain, 56/216, selected from the panmixis showed great improvement over 47/10 and has been sent for spinning tests.

To sum up, advances are being made in all the requisite characters but sufficient information is not yet available to channel the progeny into set families with grouped advantageous characters and a good degree of uniformity within each family.

It was, however, observed that in the bulk plantings the 1956 selections, after 3 years of reselection, produced more uniform plants within strains than the selections from previous years. Selfed lots of all these strains have been maintained.

The selection index technique.—Twenty 1956 progeny from 5 parent types were planted in randomised blocks, 4 replications, plot size 1/968 acre. Measurements were made for bolls per plant, seeds per boll and lint per seed. Nearby, 20 plants from each progeny were planted and selfed. Each of these plants was tested for lint length, G.O.T., and lint index. From the results of the progeny row tests, using the selection index, 21 new selections were taken from the selfed plots. These were taken from the 5 best progenies and were the plants showing the best results for lint, G.O.T. and lint index. These twenty-one 1958 progenies will be planted in replicated progeny rows and the same tests will be applied next year.

I am indebted to Mr. Sreedharan, Department of Agriculture, for doing the computations for this trial.

The panmixis bulk was rogued for jassid susceptibility and only the first two picks were harvested, to obtain a high proportion of early maturing types. These will be planted next year and the same procedure adopted.

Northern Province.

Both district trials in the Northern Province, one at Mbuguni, 20 miles from Arusha, and one at Uru Chini, 10 miles from Moshi, were irrigated. These trials are treated separately, as growing conditions differ from the Eastern Province, especially in the pattern of associated crops and the rainfall. Pests are present, but to what extent has yet to be defined. Shed boll counts this season showed that considerable damage was caused by American, pink and spiny bollworms and stainers. These points also apply to parts of Tanga Province. The Government entomologist stationed near Arusha is to commence investigations on pests in these areas next season. A spacing and time-of-planting trial, with and without insecticide, was planted at

Mbuguni and a variety trial planted at both sites. The Mbuguni plot was completely defoliated by red spider mite (following routine insecticide applications) after flowering and the results obtained are not reliable.

At the Moshi plot results were excellent. The average yield was 2,745 lb. seed cotton per acre. The trial was planted on 20th March at 3 ft. × 1 ft. spacing, thinned to 1 plant per hole. Spray insecticide was used at the recommended rates. Some details of the results are shown in Table 7, where the comparison with results in the Eastern Province can be noted.

Irrigation Schemes.

Cotton was tried as a possible cash crop for the proposed Rufiji Basin irrigation schemes at the three trial farms run by the Tanganyika Agricultural Corporation at Beta in the Rufiji Delta, Lumemo in the Kilombero valley, and Mbarali on the Bohora flats. Yields and the growth of cotton were good at all three farms. Trials were conducted by recorders from Ilonga, helped by the farm managers at Lumemo and Mbarali. Comparisons were made of dates of planting, varieties, and insecticide use.

At Lumemo the water table is too high and the best yields were 1,600 lb. seed cotton per acre. At Mbarali, where the growing conditions were good, yields in some plots reached 3,000 lb. The soil is very heterogeneous, ranging from pockets of sand to small areas of good alluvial soils. At both these sites the standard routine spraying treatment was effective against heavy bollworm and stainer attacks. Dusting was not effective at Mbarali, owing to constant high winds which blew the dust away.

At Lumemo the results indicate that the Sudan varieties are unsuitable. Jassid and blackarm caused much damage in these trials and the Sudan variety gave only 40% of the yield of the control I158. The Ukiriguru and Uganda strains gave yields as good as the control but no variety was outstanding.

At Mbarali jassid was absent and blackarm negligible. The results were badly affected by the soil heterogeneity. Heavy stainer attack in September showed that the slow fruiting Sudan types are not suitable. Further investigations are required to test the Ukiriguru, Uganda, and Ilonga types.

The best date of planting has been defined as between the end of December and early February. More information is required on this point. March plantings resulted in a 50% drop in yield.

The primary problem in cotton growing in these schemes is to obtain an efficient workable system of water application. Both the plant development and the economics of the scheme are affected by this.

Trials have been designed in co-operation with Mr. E. R. John of the Tanganyika Agricultural Corporation to test, in the coming season, dates of planting, rates of application and times of application of water.

A 5,000 acre pilot scheme has been started at Mbarali adjoining the trial farm, to work out the practical difficulties of large scale irrigation.

Selection of finer lint types for irrigation.—Further investigation will be continued at Ilonga when the proposed irrigated area is available. Until such time this work is to be left in abeyance as no suitable environment is available locally.

General Entomology.

BY

E. W. VALENTINE.

The American bollworm attack followed much the same pattern as usual but extended over a longer period than last year. Egg laying commenced in cotton in the third week of March, that is, with the formation of the first buds. Laying activity decreased during the following three weeks, until flowering, when it rose sharply. Damaged buds were recorded from the first week in April, the number rising steadily in the next three weeks to the equivalent of one flared square per plant. Pest control measures were begun the following week and the upward trend arrested.

The earliest records were from maize and regenerated groundnuts late in December. Two generations developed in these two hosts in the first three months of the year, and a third generation in groundnuts in May at the same time as in cotton. Bollworms were also recorded in pigeon pea during the early flowering period in March, and again in the main crop in July and August. A very high proportion of the larvae were parasitised by tachinids, and very few bollworms were found in the following months.

Spiny bollworm made its appearance at the beginning of May, the peak of population being a little later than that of American bollworm. A further increase occurred later in the season in the top crop of plants inadequately protected from pests.

Some breeding of *Dysdercus intermedius* took place in May, but did not reach large proportions until June when the first bolls began to open. The last bolls harvested in all plots were stained, the percentage becoming higher where the formation of the crop was delayed. At the completion of the harvest the stainers migrated to other hosts. *Calidea* were also probably responsible for some staining. A small population moved into cotton from an adjacent fallow area in

April, breeding taking place in May and June, particularly in unprotected plots.

In general the insect situation in the district was less severe than on the research station. Some reasonably good yields were obtained without pest control. The most devastating pest attack observed was in an area adjacent to the station where *Helopeltis* had so completely distorted plants that no fruit at all was produced.

Red spider mites again affected cotton in the experimental area. In no case were they considered to have any marked effect on yield and although they caused a discoloration of leaves, defoliation did not result. Larger colonies were found in plots which were sprayed with DDT, but contrary to expectations cotton sprayed to runoff was not at all affected. A very large number of plants have been recorded as hosts of this pest. They include several indigenous and cultivated solanums, cucurbits, legumes, castor, cassava, papaya and several weed plants. This great range of hosts could provide a very effective carryover from one growing season to the next.

Mites bred on castor seedlings in the laboratory showed a very rapid development. Complete development of females from egg to adult occupied between 7 and 9 days, in six successive generations observed. The night temperatures inside the building were artificially high, being little less than 80° F. following afternoon temperatures of above 90° F. A small number of predators including a thrips and the larvae of two species of beetles have been observed, but these do not seem to exercise effective control.

Insecticide Trials.

BY

E. W. VALENTINE.

The insecticide trials this year were concerned with the field testing of various dust formulations which are available commercially, samples of a new Shell insecticide, and pyrethrum supplied to the station.

Trial No. 1.

"Cotton dust" containing 10% DDT and 3% gamma BHC is the generally recommended formulation for the control of insect pests in African cotton growing areas. Two other formulations, both with 10% DDT but containing 3% BHC or 1% malathion, were compared with cotton dust. BHC or malathion is included in the formulations as an insurance against aphid infestation in case there is a break in the rains or an early onset of dry weather.

Combined with this trial was a test of a different planting arrangement. In many parts of the Eastern Province cotton growth

is so luxuriant that it is difficult to walk through the crop when applying insecticides. In order to open up the crop to make for easier access, the cotton was planted in double rows one foot apart leaving a gap of six feet to the next double row. As the plants were at one foot spacing in the row, the plant population was the same as in the normal arrangement.

TABLE 8.

Plot size: 1/10th acre. Layout: randomised blocks. Replications: 3. Spacing: single plants at 1 ft. spacing in 42 inch rows. Single plants at 1 ft. spacing in double rows 1 ft. apart, with 7 ft. between double row centres. Strain: 1158. Equipment: Swaine dusters. Insecticide applied weekly for 8 weeks at the rate of 1 lb. DDT per acre per week, plus the stated amounts of BHC and malathion. Valuation based on 52·63 cents. per lb. for Grade 1 seed cotton, and 20·45 cents. for Grade 3. Cost of insecticide includes transport.

Treatment.	*Spacing.*	*Yield/acre. lb. seed cotton.*	*% Grade 1.*	*Cost/acre shillings.*	*Net value/acre*
1 lb. DDT + 0·3 lb. BHC	Single row	1278	85·8	62·40	551·65
1 lb. DDT + 0·3 lb. BHC	Double row	1205	86·8	62·40	520·30
1 lb. DDT + 0·3 gamma BHC	Single row	1262	84·4	88·00	512·47
1 lb. DDT + 0·3 gamma BHC	Double row	1315	85·6	88·00	522·94
1 lb. DDT + 0·1 lb. malathion	Single row	1437	87·4	89·60	608·12
1 lb. DDT + 0·1 lb. malathion	Double row	1428	87·2	89·60	603·06
S.E.		88			
L.S.D. (P=0·05)		208			

It will be seen from the table that there was no significant difference between the yields from treatments containing 3% gamma BHC and 3% BHC, although the gamma BHC gave a slightly better result. The aphid infestation was only mild, even though there was a relatively long dry period, and did not seriously affect the crop.

The DDT plus malathion treatment gave higher yields. The advantage seems to be that the malathion gives an additional control of bollworms as well as checking aphid build-up. Grading percentage is also higher in this treatment, so that the higher yield and better grade lead to a greater net return.

There was no significant difference between yields from plots planted in double rows, and in single rows. The six foot pathway between the double rows made for much easier operation in both dusting and harvesting. This planting system might profitably be adopted in those areas where difficulties due to excessive growth are encountered.

Trial No. 2.

Samples of endrin and another insecticide designated as WL1650, supplied by Shell Chemicals, were tested against the standard DDT(+BHC) treatment.

TABLE 9.

Plot size: 1/10th acre. Layout: randomised blocks. Replications: 4. Spacing: single plants at 1 ft. spacing in 42 inch rows. Strain: I158. Equipment: Four Oaks Ross knapsack sprayers with Allman 000 nozzles. Insecticide applied weekly for 8 weeks in 7½ gallons of water per acre.

Treatment.	*Lb./ acre.*	*Yield/acre seed cotton.*	*% Grade 1.*	*Cost/ acre.*	*Total value.*	*Net value.*
WL1650	¼	2081	83·0	—	981·31	—
WL1650	½	2386	83·5	—	1128·87	—
Endrin	¼	2056	85·0	98·50	982·96	884·46
DDT + BHC*	1 + ¼	1969	89·5	147·40	969·76	822·36
S.E.		69				
L.S.D. (P=0·05)		220				

*¼ lb. BHC for 2nd month only.

The new product, which is not yet on the market, compares very favourably with both endrin and DDT in the control of cotton pests, the yield from the higher application of WL1650 being significantly greater than from other treatments. A full costing is not possible as no quotation was given for WL1650. If its cost is comparable with that of endrin it will give as economical a control applied at the same rate, and the ½ lb. application would result in a higher net return.

In these two trials no untreated controls were included in the layout. Yields from controls within the same experimental area varied between 100 lb. and 300 lb. seed cotton per acre.

Test of Pyrethrins as a Field Insecticide.

One of the difficulties in controlling cotton pests is that the protection period coincides with the period of heaviest rainfall. Rain soon after the application of insecticides is liable to reduce severely the effectiveness of the treatment. A quicker acting insecticide giving a higher initial kill, to be used in conjunction with a more persistent insecticide, would be useful in this case.

Pyrethrins were applied to cotton early in the season, as 0·06% and 0·03% sprays at the rate of approximately one-fifth and one-tenth pound per acre. Within a week of the first application there was a marked visual difference between sprayed and unsprayed plots. The effect of the spray was to restrict the breeding of jassid, treated plants producing fresh new leaf while the control continued to be damaged. This difference was accentuated with each week's spraying, but unfortunately the pyrethrins had no discernible effect upon bollworms. Damage counts increased at the same rate as in the control. From this, it seems that pyrethrins hold little promise as a cotton insecticide, except perhaps at much higher rates of application. Since DDT alone is effective against jassid, addition of pyrethrins, which is relatively expensive, does not seem to be warranted.

Demonstration Plots.

In order to demonstrate the value of spraying and the potentiality of cotton, unreplicated plots, of one-tenth of an acre, were set aside. The treatments were the standard 1 lb. of DDT (+$\frac{1}{4}$ lb. BHC) per acre, spraying to runoff with 0·1% DDT + 0·025% BHC, and untreated control. Each plot was split for double and single rows. Yields are set out in Table 10.

TABLE 10.

YIELDS FROM DEMONSTRATION PLOTS, EQUIVALENT TO POUNDS OF SEED COTTON PER ACRE.

Sprayed weekly for 8 weeks from April 25th.

Treatment.	*Double row.*	*Single row.*	*% Grade 1.*
Standard spray	1990	1790	94·8
Runoff spray	2900	2840	89·5
Control	133	170	65·6

This demonstration was impressive, particularly the crop in the plots sprayed to runoff. The latter shows the high potential of cotton in this area, but such a treatment is impracticable as water at the rate of over 100 gallons per acre was required to give overall cover. However, the standard treatment gave very satisfactory protection against insects.

The Recovery of Cotton from Loss of Crop.

It is well known that cotton is capable of compensating for a loss of fruits early in its development, and that continued loss leads to the formation of a "top crop" which, depending on conditions, may or may not mature. A preliminary trial was conducted in order to obtain a more precise measure of the recovery of plants from the loss of fruits by insect damage and by mechanical removal for varying periods. A replicated trial in two sections was set out with plots of ten plants in the row and separated by 7 ft., records being taken from the first five plants in each row.

Section I.—In this, the cotton was allowed to be damaged by insects for periods of 1, 2, 3 and 4 weeks after the beginning of the bollworm attack, and for the whole season. After each successive delay in protection the plants were sprayed weekly to runoff until the completion of harvest. Accurate weekly counts of damaged and fallen buds and bolls were made, and an analysis of the condition of every opened boll. These records are very briefly summarised below.

TABLE 11.

Figures are fruits or opened bolls per plant. Averages to the nearest 0·1. A – loss before protection. B – loss during protection period. Cotton variety 1158.

Treatment	Fruits recorded	Fruits lost			Bolls harvested		% Grade 1 seed cotton
		A	B	Total	Total	Saleable	
1 week damage	76·2	2·0	22·8	24·8	51·4	46·2	92·6
2 ,,	80·2	9·3	21·9	31·2	49·1	44·3	90·7
3 ,,	92·6	21·4	23·5	44·9	47·7	41·7	82·0
4 ,,	119·6	32·0	27·9	59·9	59·7	41·8	62·0
Control	132·9	109·5	—	109·5	23·4	13·6	73·8

The outstanding result of this trial is that in all treatments the plants recovered, after protection, to such an extent as to produce saleable yields which were not significantly different from one another. The general effect of the delay in protection was a delay in the setting of the crop which eventually matured. However, with each delay in pest control, the grade of the harvest decreased. This was due to partially damaged early bolls before spraying commenced, and in the case of the later developing bolls, to stainers which were not adequately controlled.

The harvest of each treatment extended over approximately the same period, eleven to twelve weeks from first to last open boll, with the peak harvest a little later in each succeeding treatment. In those plots where protection was delayed for a longer period there was a tendency towards a double peak harvest curve, low for the crop from bolls set before protection, and higher from bolls set after protection.

It may appear from these results that protection could be delayed for up to one month without affecting final yields, but when the quality of the harvest is considered it will be seen that the proportion of clean bolls is very much reduced. Such a recovery from damage is unlikely to occur with ordinary routine pest control measures, and the figures support the recommendation that early protection will give the most efficient control of pests.

Section II.—Complete bud removal for the same period of insect damage as in Section I.

Plants were sprayed to runoff throughout the season to minimize insect damage as far as possible, and all buds removed for periods of 0, 1, 2, 3 and 4 weeks after the beginning of the bollworm attack. This represents the removal of approximately six, seven, eight and nine weeks of bud formation. A weekly record was made of any damaged or shed fruits, and bolls were analysed as they opened.

The immediate reaction to bud removal was increased growth, greater leaf size and number, and rapid production of buds. In naturally developing plants, that is, those from which no buds were removed, the crop was harvested over a period of twelve weeks. After the removal of six weeks' production of buds, the harvest extended over eight weeks, and with each further week of disbudding the time from first to last open boll was reduced to seven, six and five weeks respectively.

TABLE 12.

Figures are of fruits or open bolls per plant. Averages to the nearest 0·1. "Shed fruits" include a small proportion which were damaged by insects. Cotton variety I158.

Buds removed	*Fruits recorded*	*Fruits lost*			*Bolls harvested*		*% Grade 1 seed cotton*
		Removed	*Shed*	*Total*	*Total*	*Saleable*	
0	93·0	—	29·5	29·5	63·5	57·0	91·6
1 week	136·4	45·8	36·4	82·2	54·2	49·9	92·6
2 weeks	139·9	55·1	36·4	91·5	48·4	43·9	93·9
3 weeks	187·2	89·6	31·9	121·2	66·0	61·3	90·0
4 weeks	239·1	124·6	36·3	160·9	69·2	62·3	68·6

It will be seen from Table 12 that all treatments lost approximately the same number of fruits per plant following bud removal, owing to physiological causes. As those plants from which a greater number of buds had been removed also produced a greater total number of fruits, this loss was proportionately smaller. The larger plants were able to maintain and mature a higher proportion of fruits produced, and consequently a greater absolute number of bolls.

In the virtual absence of insect pests the proportion of clean cotton was very high. The treatment in which crop formation was delayed for the longest time, however, suffered severely from staining. Pink bollworm infestation was also more marked in this late crop.

Routine Pest Control.

Most of the Plant Breeder's bulk and experimental plots were sprayed rather than dusted. This resulted in a much more efficient control of pests than has been achieved in the past, and less variation in yield from different parts of the experimental area. The standard rate of 1 lb. DDT ($+\frac{1}{4}$ lb. BHC in the second month) in about 7 gallons of water per acre was applied by a gang of six operators using knapsack sprayers. The practicability of spraying bulk plots with a tractor mounted boom sprayer will be tested next season.

Appendix.

Summary of Strains.

Eastern Province Local	The original commercial cotton in the Province, mainly of Uganda Local origin. Strains prefixed by the figures 44-58, which indicate the year of origin, are all selections or reselections from Local.
47/10	A selection from Local; the current commercial cotton of the Province.
I158	A multiline issue composed of 7 strains with improved yield and ginning outturn. At present being multiplied to replace 47/10.
Uk51	The current commercial cotton in the Lake and Tanga Provinces.
BP52	The present commercial cotton in Northern Province, having been imported from Uganda.
UPA8	Selection from (MU × $BP52^2$) × Albar 51, imported from Namulonge.
54/379	Ex 51/93, a selection from Eastern Province Local.
51/77 51/111	Ex Eastern Province Local.
56/216	Ex panmixis bulk.

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PROGRESS REPORTS FROM EXPERIMENT STATIONS

The reports for the seasons up to and including 1950-51 were published in seasonal volumes; the following are still in print and available at 3/- per volume post free.

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From 1951-52 the reports from each territory were published individually each season A few of the 1951-52 reports are out of print, but all others are available post free at 1/- per report or 7/6d for the seasonal set